VOLUME 24 ISSUE 3

The International Journal of

Assessment and Evaluation

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MANSYUR, SYAHRUL, AND AKBAR ISKANDAR

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THE INTERNATIONAL JOURNAL OF ASSESSMENT AND EVALUATION
http://thelearner.com
ISSN: 2327-7920 (Print)
ISSN: 2327-8692 (Online)
http:/doi.org/10.18848/2327-7920/CGP (Journal)

First published by Common Ground Research Networks in 2017
University of Illinois Research Park
2001 South First Street, Suite 202
Champaign, IL 61820 USA
Ph: +1-217-328-0405
http://cgnetworks.org

The International Journal of Assessment and Evaluation
is a peer-reviewed, scholarly journal.

Common Ground Research Networks, a member of Crossref

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Assessing the Critical Thinking Ability of Junior High School Students in Makassar and Gowa in South Sulawesi

Mansyur,[1] Universitas Negeri Makassar, Indonesia
Syahrul, Universitas Negeri Makassar, Indonesia
Akbar Iskandar, STIMIK AKBA Makassar, Indonesia

Abstract: The purpose of this study was to provide an overview of the critical thinking skills and tendencies of math students in junior high school in the cities of Makassar and Gowa in South Sulawesi. It discusses the differences in critical thinking abilities based on the students' region of origin and gender and their parents' occupation and income. The research was conducted from April to July 2016 with a sample of as many as 927 students from Class VII. The results showed that the critical thinking skills of math students consist of three categories: good (69.3%), very good (25.1%), and poor (5.6%). There was no difference between the critical thinking skills of students who came from villages compared to those who came from towns, but there were differences between male and female students' critical thinking skills. Female students' critical thinking skills ranked higher than those of the male students. The occupation and income of the students' parents did not have a significant effect on their critical thinking skills.

Keywords: Critical Thinking Ability, Gender, National Origin, Parents Income, Parents Work

Introduction

While learning assessments in schools are a common way to gauge a student's progress, the information obtained from these assessments does not show the whole picture of the student. Emphasis is placed on cognitive domains that are likely at a low level of thinking (Mansyur 2011). As such, the purpose of these assessments is limited to uncovering students' skills. In fact, an assessment with the aim of establishing high-level thinking skills has still not been used by teachers at any level of schooling. The ability of a student to think critically, creatively, and proactively is one of the pillars of the Ministry of Education and Culture of the Republic of Indonesia that needs serious attention from all education stakeholders.

Another difficulty facing teachers in primary and secondary schools is the inability of some teachers to motivate students to learn. A number of students have doubts and misgivings when facing the National Examination, which results in high levels of boredom during the learning process, especially in mathematics (Mansyur 2011). This arises directly from the failure of teachers to utilize self-assessment to establish critically, creatively, and proactively thinking students.

To provide an overview and instructions for teachers to develop students' thinking skills through assessment, Earl (2003) suggests using the concept of self-assessment. In this view, self-assessment tests the essence of the subjects learned, the character of the student, and the student's thinking skills (Earl 2003). Stiggins et al. (2004) revealed that self-assessment could motivate and build self-confidence, discipline, honesty, and hard work in students as well as improving teaching and learning.

Research on the critical thinking of mathematics students at the secondary school level, *Sekolah Menegah Pertama* (SMP), especially in South Sulawesi, is still rare. However, the competency standards at the secondary education level show that the ability of logical, critical,

[1] Corresponding Author: Mansyur, Jalan Bonto Langkasa, Educational Research and Evaluation, Universitas Negeri Makassar, South Sulawesi, 90222, Indonesia. email: mansyurunm@gmail.com

The International Journal of Assessment and Evaluation
Volume 24, Issue 3, 2018, http://thelearner.com

ISSN: 2327-7920 (Print), ISSN: 2327-8692 (Online)
http://doi.org/10.18848/2327-7920/CGP/v24i03/25-35 (Article)

creative, and innovative thinking is also related to the ability to learn independently and to demonstrate the capacity to analyze and solve problems in everyday life.

Critical thinking skills involve a continuous process of thinking, both active and conscientious, which aims to make a rational decision not only to seek answers but also to solve educational problems in mathematics, such as having less motivation and the way teachers teach in the classroom. Therefore, innovative innovative efforts are needed to improve and enhance the quality of mathematics learning through improvements of the learning process, which first requires the gathering of information about the students' critical thinking abilities. Moore and Parker (1986) also pointed out that critical thinking requires many skills, including listening, careful reading, seeking and obtaining hidden assumptions about students' skill, attitude, and ability, and exploring the consequences of a statement.

Ennis (1993) explains the purpose of assessing critical thinking in students, namely to diagnose the level of critical thinking ability, to provide feedback on the students' ability to think critically by giving reviews, and to motivate students to become better at critical thinking. Ennis's (1993) opinion illustrates that, during the learning process, teachers need to know information about students' critical thinking skills. Teachers' prior knowledge about the students' critical thinking skills will provide direction and guidance for the teachers to prepare appropriate learning strategies so that the students' learning will be more effective and efficient. This is why the researchers are interested in researching the critical thinking abilities of junior high school mathematics students in Makassar and Gowa.

Based on the explanation above, the researchers formulated the following research questions:

1. Is there any difference of students' critical thinking ability based on their origin of area?
2. Is there any difference of students' critical thinking ability based on their gender?
3. Is there any difference in students' critical thinking skills based on their parent's job?
4. Is there any difference in students' critical thinking ability based on their parent's income?

Research Methods

This ex post facto research aimed to uncover facts that had occurred before the research was conducted and their relationships to some of the variables (Watson 2012). This research was conducted from April to July 2016 in the cities of Makassar and Gowa in South Sulawesi. The study sample consisted of as many as 927 students from Class VII at four junior high schools, namely SMPN 1 Palangga, SMPN 7 Makassar, Makassar Assa'diyah Madrasah, and SMP Muhammadiyah 3 Bontoala Makassar. From the number of samples, the distribution based on demography is as follows: First, there were 428 male (46.17%) and 499 female (53.83%) participants. Second, there were 328 people (35.38%) from Gowa Village and 599 people (64.62%) from the city of Makassar. Third, the participants came from parents with various jobs, namely 116 civil servants (12.51%), 128 private employees (13.81%), 232 farmers (25.03%), 418 self-employed (45.09%), and 232 other jobs (25.03%). Fourth, they came from parents with a certain income level in which 637 people (68.7%) with an income less than 2 million Indonesian rupiah, 161 people (17.4%) with an income from 2 to 4 million Indonesian rupiah, seventy-nine people (8.5%) with an income from 4 to 5 million Indonesian rupiah, thirty-seven people (4.0%) with an income from 5 to 10 million Indonesian rupiah, and thirteen people (1.4%) with an income greater than 10 million Indonesian rupiah. Sampling was done using a stratified random sampling technique which was based on the accreditation of the school (Krathwohl 1998). The four schools were selected to represent the accreditation levels of A, B, C, and those that have not been accredited.

The data were obtained using a questionnaire to evaluate the critical thinking skills of mathematics students, consisting of five indicators and thirty-nine points. The indicators in the questionnaire were to give a simple explanation, build basic skills, make inferences, give further explanation, and determine strategies and techniques in solving math problems. The questionnaire tested the construct and the validity and reliability of constructs using a confirmatory factor analysis. All items on the questionnaire were valid criteria and had a reliability of 0.92. The data were analyzed with descriptive statistics and an inferential statistical analysis of the variance of the lane. The questionnaire used was developed by the research team and has been tested for content validity through focus group discussions involving three experts. In addition, pilot testing was given to 800 respondents who have the same characteristics as the sample of research conducted in four schools, two schools in Makassar City and two schools in Gowa Village, in order to know the construct validity and reliability of the questionnaire. The data were analyzed by using confirmatory factor analysis. All the questionnaires have fulfilled the criterion of construct validity that has a loading factor > 0.3 and reliability of 0.92 which is greater than criterion 0.7 (Linn 1989). The data were analyzed using descriptive statistical and inferential statistical analysis of one-way variance.

Results and Discussion

The results of the descriptive statistical analysis showed that the students' critical thinking skills had an average score of 117.64, a median of 118.00, a mode of 116.00, a standard deviation of 12:32, a variance of 151.98, a range of eighty, a minimum score of seventy, and a maximum score of 150.00. The criteria for the critical thinking skills of math students consisted of four categories: very good, good, poor, and very poor. The distribution of scores for each criterion is presented in Table 1.

Table 1: Criteria Score Range and Critical Thinking Skills

Score Range	*Criteria*
$127.50 < \text{Score} \leq 156$	Very good
$97.5 < \text{Score} \leq 127.75$	Good
$68.25 < \text{Score} \leq 97.5$	Poor
$39 \leq \text{Score} \leq 68.25$	Very Poor

Source: Author's Own Composition

Based on the analysis of data and trends of the four criteria provided, only three occurred in this sample: very good, good, and poor. The distribution for each criterion tendency is presented in Table 2.

Table 2: Criteria and Percentage of Students' Critical Thinking Skills

Criteria	*Frequency*	*Percentage (%)*
Very good	233	25.1
Good	642	69.3
Poor	52	5.6
Total	927	100

Source: Author's Own Composition

Observing the information presented in Table 2 above, it appears that out of the 972 students, 642 (69.3%) have a good critical thinking ability, 233 people (25.1%) were very good, and 52 (5.6%) were less good at mathematics.

The results of the descriptive statistical analysis based on region of origin shows that as many as 328 students (35.4%) came from villages while as many as 599 (64.6%) came from

cities. The average score for the critical thinking skills of students from villages was 117.26 with a standard deviation of 13.98 and a median of 118.00. The average score of city students' critical thinking skills was 117.85 with a standard deviation of 11.32 and a median 118.00. A comparison of descriptive statistics of the students' critical thinking ability scores by region of origin is presented on a box plot as shown in Figure 1.

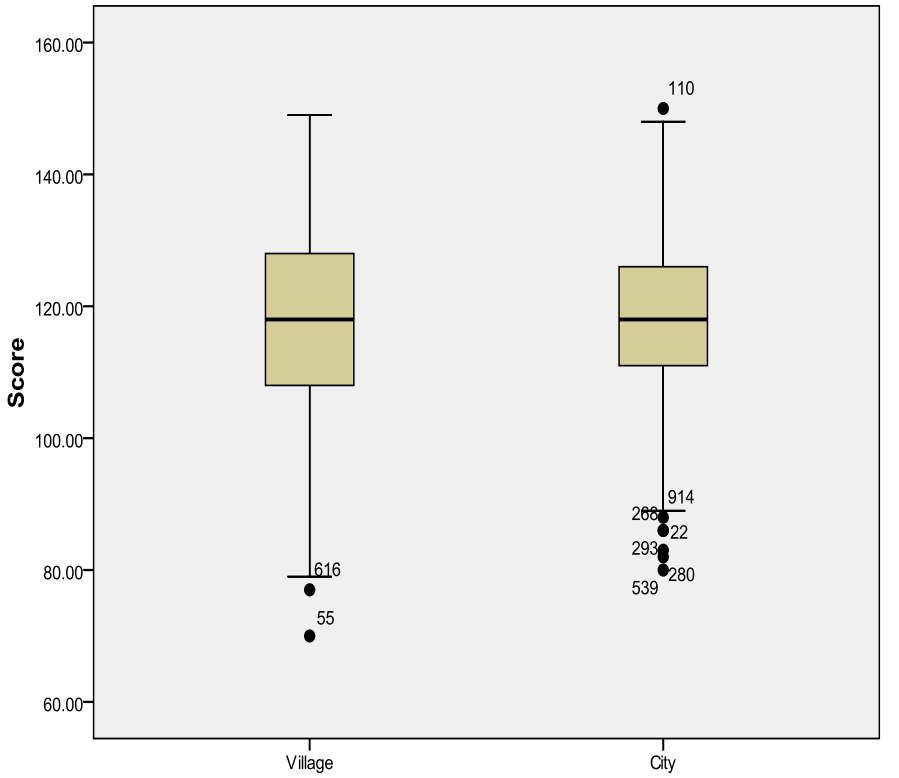

Figure 1: Comparison of Box Plot Descriptive Statistics of Student Scores between Village and City
Source: Author's Own Composition

In the gender study, the sample consisted of 428 male students (46.2%) and 499 female students (53.8%). The results of the descriptive statistical analysis showed that the average score of male students' critical thinking skills was 116.20, with a standard deviation of 13.13 and median of 116. The average score of the female students' critical thinking skills was 118.89, with a standard deviation of 11.46 and a median of 119. For clarification purposes, the information is presented in a box plot as shown in Figure 2.

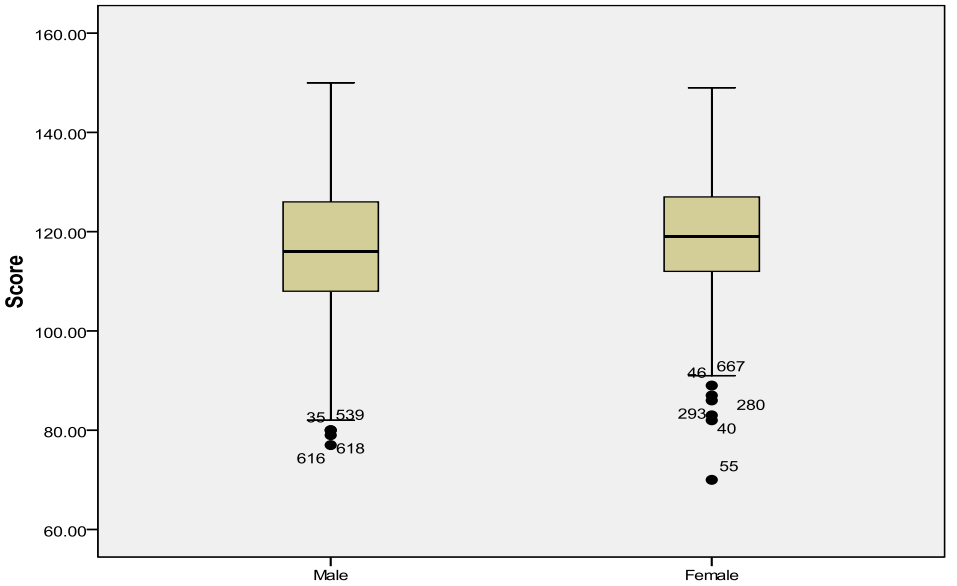

Figure 2: Comparison Box Plot Descriptive Statistics Student Scores between Male and Female
Source: Author's Own Composition

For the portion of this study dedicated to the parents' professions, the sample consisted of as many as 116 civil servants (PNS) (12%), as many as 128 private employees (13.8%), thirty-three farmers (3.6%), 418 self-employed people (45.1%), and 232 who classified their jobs as "other" (25%). A summary of the results of the descriptive statistics of students' critical thinking skills score as based on the parents' occupation is presented in Table 3.

Table 3: Descriptive Statistics of Students'
Critical Thinking Skills Based on the Profession of Parents

Parents' Job	*Mean*	*N*	*Std. Deviation*	*Median*
PNS	117.2672	116	12.03065	118
Private Employees	118.5078	128	11.57855	118
Other Work	118.1336	232	12.98232	118
Farmer	117.7273	33	14.71877	120
Entrepreneur	117.2177	418	12.0907	117
Total	117.6494	927	12.32826	118

Source: Author's Own Composition

In descriptive statistics, the information presented in Table 3 above shows that the average score of the critical thinking ability of students whose parents are private employees is higher than in the PNS, farmer, self-employed, and other categories.

The parents' income in this study is divided into five categories: 637 persons earned less than 2 million rupiahs (68.7%), as many as 161 people earned 2–4 million rupiahs (17.4%), as many as seventy-nine people earned 4–5 million rupiahs (8.5%), a total of thirty-seven people had an income of 5–10 million rupiahs (4.0%), and thirteen earned more than 10 million rupiahs (1.4%). A summary of the results of the descriptive statistics score of the critical thinking skills of students based on their parents' income is presented in Table 4.

Table 4: Descriptive Statistics of Students' Critical Thinking Skills Based on Parents' Income

Parents' Income (X)	*Mean*	*N*	*Std. Deviation*	*Median*
X <2 million	117.1586	637	12.33004	118
2 million ≤ X < 4 million	117.5466	161	13.0953	117
4 million ≤ X < 5 million	120.557	79	10.88842	121
5 million ≤ X ≤ 10 million	118.7297	37	10.54	118
X > 10 million	122.2308	13	13.61466	126
Total	117.6494	927	12.32826	118

Source: Author's Own Composition

In descriptive statistics, the information presented in Table 4 above shows that the average score of the critical thinking skills of students whose parents' income is greater than 10 million is higher than students with parents of other incomes.

The inferential statistical analysis is done by using the statistical analysis of variance in the path to examine differences in the students' critical thinking skills based on regional origin (rural and urban), gender (male and female), and the parent's occupation and income. Before the inferential analysis, required analysis tests were conducted to test normality and homogeneity. The normality test results showed that all of the data come from populations that are considered to have a normal distribution. Likewise, the results of the homogeneity test analysis showed that the group was homogeneous. An elaboration on the inferential statistical test results is described below.

Critical Thinking Skills of Students Based on Regional Origin

The study's hypothesis was that there would be differences in the students' critical thinking skills in the learning of mathematics based on their region of origin. For the statistical test, the hypothesis is formulated:

Ho: $\mu 1 = \mu 2$ against H1: $\mu i \neq \mu 2$

This is based on calculations by the t-statistic tests as presented in Table 5.

Table 5: Results of t-Test Differences in the Ability of Critical Thinking Based on Regional Origin

		t-Test for Equality of Means				
		T	*Df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*
Score	*Equal variances assumed*	-0.702	925	0.483	-0.59452	0.84705
	Equal variances not assumed	-0.66	564.124	0.509	-0.59452	0.90032

Source: Author's Own Composition

The information presented in Table 5 shows that the value of "T" is calculated at -0.702 and 925 degrees of freedom, and the value of the calculation results in the significance (p) of 0.483. If the significance value calculation results are compared with the significance of $\alpha = 0.05$, then it is found that the value of $p = 0.483$ is greater than the value of $\alpha = 0.05$. This shows that the hypothesis Ho is accepted, so it was concluded that there was no difference in critical thinking ability among students who came from villages and students who came from cities.

These results are consistent with the results of research conducted by Alokan and Arijesuyo (2013), which state that there is no significant difference between the academic performances of students from rural and urban areas. The results of this study also corroborate the results of

research by Graham and Provost (2012), which reveals that there is no difference in the mathematics achievement levels of children from rural and urban areas. However, these results differ from the results of research that has been done by Owoeye and Yara (2011), which state that students in urban areas have better academic achievement levels than those from the countryside. The differences in the results of this study and the results of Owoeye and Yara's (2011) research are allegedly due to the cultural differences of the different samples, as South Sulawesi culture differs from the culture of Nigeria.

Critical Thinking Skills of Students by Sex

The hypothesis that there are differences in the students' critical thinking skills based on the occupation of their parents was also tested. For the statistical test, the hypothesis is formulated:

Ho: $\mu 1 = \mu 2 = \mu 3 = \mu 4 = \mu 5$ against H1: $\mu i \neq \mu j$ for some i and j

The results of the analysis of variance in the statistical calculations to determine differences in students' critical thinking skills based on their parents' occupations is presented in Table 6.

Table 6: Test Results Analysis of Variance in Critical Thinking Skills by Parents' Occupations

	Sum of Squares	*Df*	*Mean Square*	*F*	*Sig.*
Between Groups	243.757	4	60.939	0.4	0.809
Within Groups	140495.3	922	152.381		
Total	140739.057	926			

Source: Author's Own Composition

Based on the information presented in Table 6 above, it appears that the calculated F value is 0.400 with four degrees of freedom, the numerator and denominator have 922 degrees of freedom, and the value of the calculation results in a significance (p) of 0.809. If the significance value calculation results are compared with the significance of $\alpha = 0.05$, then it is found that the value of $p = 0.809$ is greater than the value of $\alpha = 0.05$. It shows that Ho is the accepted hypothesis (and H1 was rejected), and so it was concluded that in general there is no difference in the critical thinking skills of students based on the work of their parents. The results of this study indicate that parents' employment type does not have an effect on the critical thinking skills of students in the learning of mathematics. However, the active involvement of parents in educating and motivating children in the neighborhood is required by children. This is in line with Al-Matalka's study (2014), who expressed that parental involvement at home is important regardless of the parents' socioeconomic status, for successful parental involvement can help children achieve a better education. Carter (2002) also explains that parental participation in their children's education contributes significantly to student learning outcomes.

Furthermore, Shaver and Walls (1998) add that the achievement of mathematics learning outcomes of all socioeconomic statuses are influenced by the involvement of parents and family (Carter 2002). Mganga and Mizambwa (1997) add that educated parents tend to motivate their children in matters relating to education and to support them academically. However, the influence of educated parents in the academic achievement of their children is low. It is therefore natural that students whose parents work as private sector employees have a better critical thinking ability than students whose parents are civil servants, self-employed, farmers, and other workers, because there is a relationship or influence between the profession of parents and their children's ability to think critically in mathematics.

Critical Thinking Skills of Students Based on Parents' Income

The hypothesis was tested that there are differences in mathematics students' critical thinking skills based on the income of their parents. For the purposes of the statistical test, the hypothesis is formulated:

Ho: μ1= μ2=μ3 = μ4 = μ5 against H1: μi ≠ μj for some i and j

The results of the statistical analysis of variance test calculations on this hypothesis are presented in Table 7.

Table 7: Test Results Analysis of Variance in Critical Thinking Skills by Parents' Income

	Sum of Squares	*Df*	*Mean Square*	*F*	*Sig.*
Between Groups	1139.072	4	284.768	1.881	0.112
Within Groups	139599.985	922	151.41		
Total	140739.057	926			

Source: Author's Own Composition

Observing the information presented in Table 8 above, it appears that the value of F is equal to 1,881 with four degrees of freedom, the numerator and denominator have 922 degrees of freedom, and the value of the calculation results in a significance (p) of 0112. If the significance value calculation results are compared with the significance of α = 0.05, then it is found that the value of p = 0112 is greater than the value of α = 0:05. It shows that Ho is the accepted hypothesis (H1 was rejected), so it was concluded that in general there is no difference in the critical thinking skills of students based on the income of their parents. To be able to know where the parent's income did affect the students' critical thinking abilities in mathematics, a post hoc test was then conducted. A summary of the post hoc test results are presented in Table 8.

Table 8: Difference in the Post Hoc Test of Students' Critical Thinking Skills Affected by Parents' Income

(I) Parents' Income (X)	*(J) Parents' Income (X)*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*
X <2 million	2 million ≤ X < 4 million	-0.38803	1.08542	0.721
	4 million ≤ X < 5 million	-3.39841*	1.46774	**0.021**
	5 million ≤ X < 10 million	-1.57117	2.08083	0.45
	X > 10 million	-5.07221	3.44741	0.142
2 million ≤ X < 4 million	X <2 million	0.38803	1.08542	0.721
	4 million ≤ X < 5 million	-3.01038	1.69027	0.075
	5 million ≤ X < 10 million	-1.18315	2.24334	0.598
	> 10 million	-4.68419	3.54787	0.187
4 million ≤ X < 5 million	X <2 million	3.39841*	1.46774	**0.021**
	2 million ≤ X < 4 million	3.01038	1.69027	0.075
	5 million ≤ X < 10 million	1.82723	2.45127	0.456
	> 10 million	-1.67381	3.68287	0.65
5 million ≤ X < 10 million	X <2 million	1.57117	2.08083	0.45
	2 million ≤ X < 4 million	1.18315	2.24334	0.598
	4 million ≤ X < 5 million	-1.82723	2.45127	0.456
	> 10 million	-3.50104	3.96725	0.378
X > 10 million	X <2 million	5.07221	3.44741	0.142
	2 million ≤ X < 4 million	4.68419	3.54787	0.187
	4 million ≤ X < 5 million	1.67381	3.68287	0.65
	5 million ≤ X < 10 million	3.50104	3.96725	0.378

Source: Author's Own Composition

As shown in Table 8 above, only the parents who earn less than 2 million and those with an income of between 2 million and 4 million rupiahs (shown in bold) have significant value

calculation results (p) = 0.021 that are less than the significance α = 0.05. This means that there are differences in the students' critical thinking skills between students whose parents earn less than 2 million and students whose parents' income is between 2 million and 4 million. In general, the results of this study are consistent with the opinion of Mayer (2002), which is that the effect of parental income on cognitive test results in children is quite small, but there are contributing genetic and environmental factors. Drajea and O'Sullivan (2014) add that poverty regarding family resources has a strong influence on a child's ability to respond to educational opportunities. Gratz et al. (2006) explains that a lot of the research has revealed that low-income families are less involved in the education of their children, and because of the lack of participation of the parents, their children are not likely to be successful in school. Finally, Wyner, Bridgeland, and Dilulio (2009) revealed that there are millions of low-income students in the United States, from urban communities, suburbs, and rural areas, who excel in school; only a low number drop out of school at the high school level, and more than 90 percent of them enter college.

Even so, from the results of this analysis we can see that between the five salary scales, there are two wage levels—parents with an income of less than 2 million and parents with an income of between 2 and 4 million—who provide different capabilities to their students' critical thinking. This last result is in line with the opinion of Alordiah et al. (2015), which revealed that based on the socioeconomic status of elderly people, there are significant differences in the academic achievements of mathematics students. This means that students who have parents with a higher economic status have a better math performance than their counterparts from parents who have a lower economic status. Furthermore, Kapinga (2014) explains that children whose families had incomes below the poverty line are much more successful in educating their children in the field of education than children living in families with incomes above the poverty threshold.

Conclusion

Pursuant to the results of the research and discussions that have been described in the previous sections, we can come to several conclusions. First, the critical thinking skills of the 927 mathematics students in the sample consisted of three categories: good (69.3%), very good (25.1%), and poor (5.6%). There is no difference in critical thinking abilities among students who come from villages and cities, but there are differences in critical thinking skills between males and females. Female students have better critical thinking skills than male students. However, there is no difference in critical thinking ability based on their parents' occupation, and in general there is no difference in the critical thinking skills of the students based on their parents' income.

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ABOUT THE AUTHORS

Mansyur: Senior Lecturer, Educational Research and Assessment, Universitas Negeri Makassar, Makassar, South Sulawesi, Indonesia

Syahru: Lecturer, Engineering Faculty, Universitas Negeri Makassar, South Sulawesi, South Sulawesi, Indonesia

Akbar Iskandar: Lecturer, Information and Technology, STIMIK AKBA, Makassar, South Sulawesi, Indonesia

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ISSN: 2327-7920